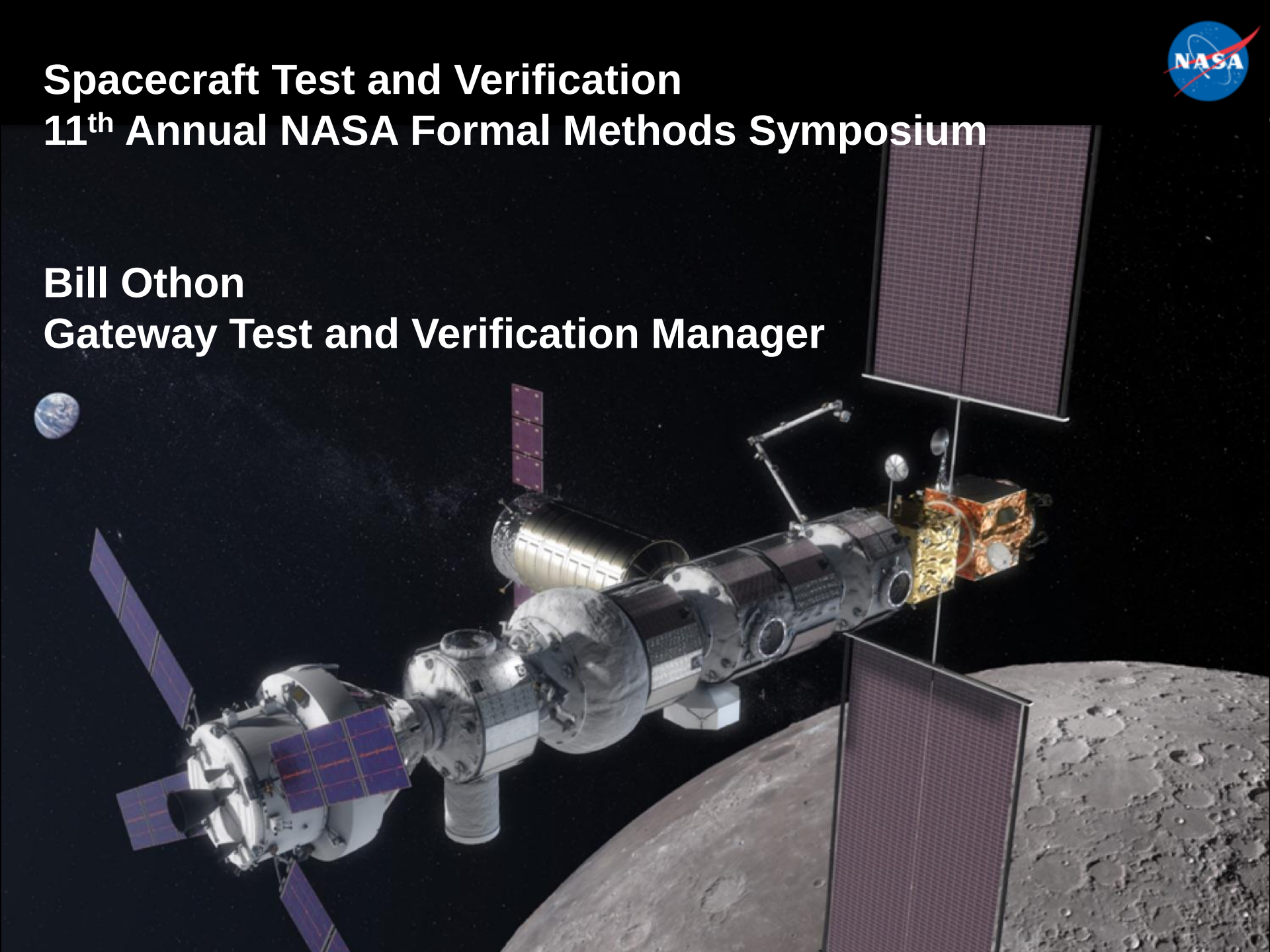
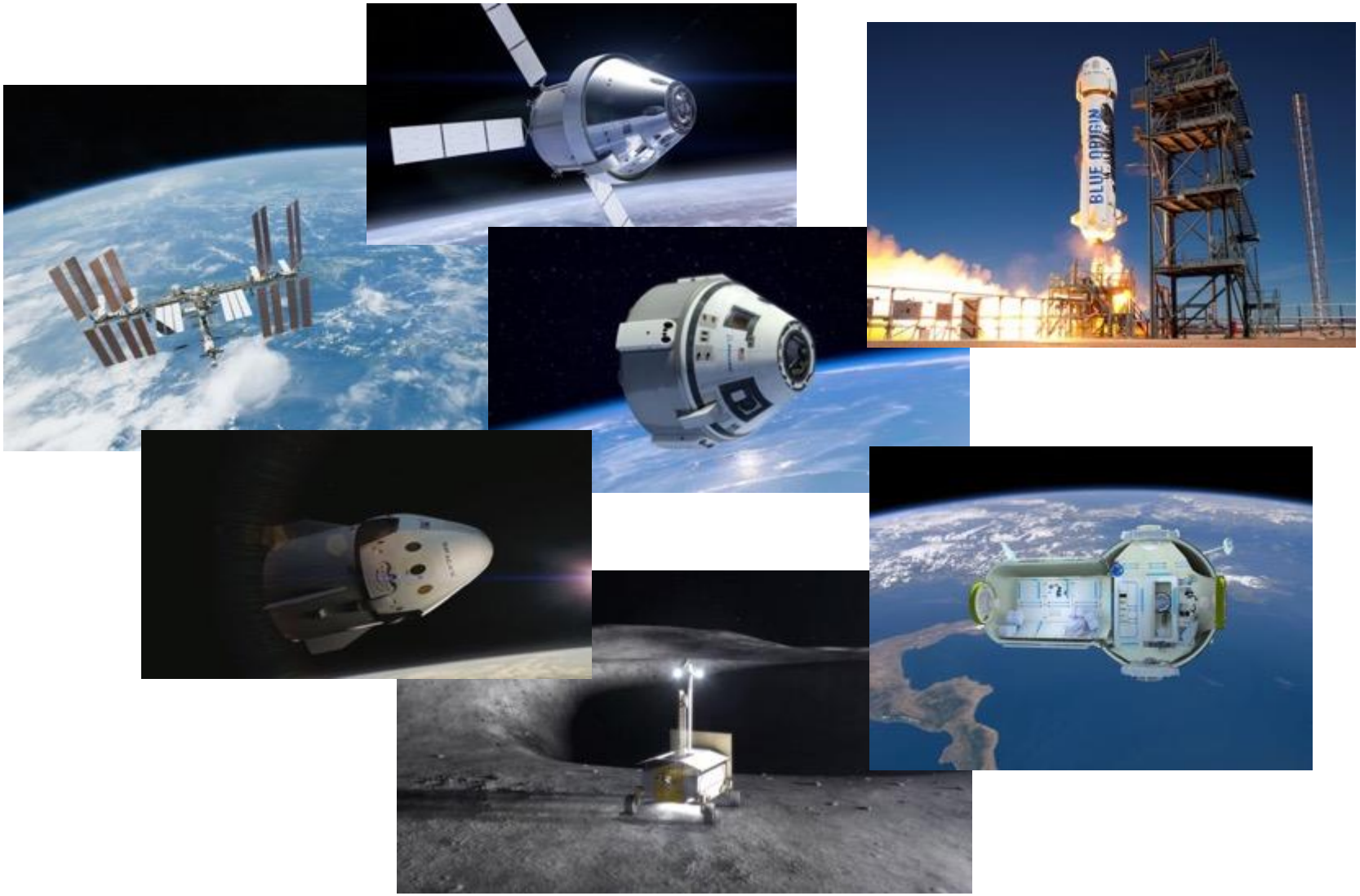
Spacecraft Test and Verification
11th Annual NASA Formal Methods Symposium

Bill Othon
Gateway Test and Verification Manager



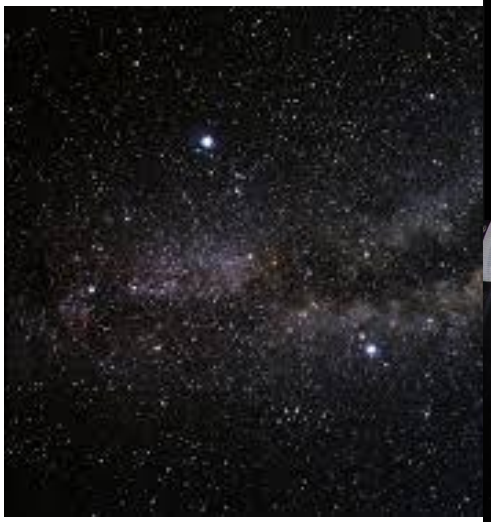
Golden Age of Human Space Travel

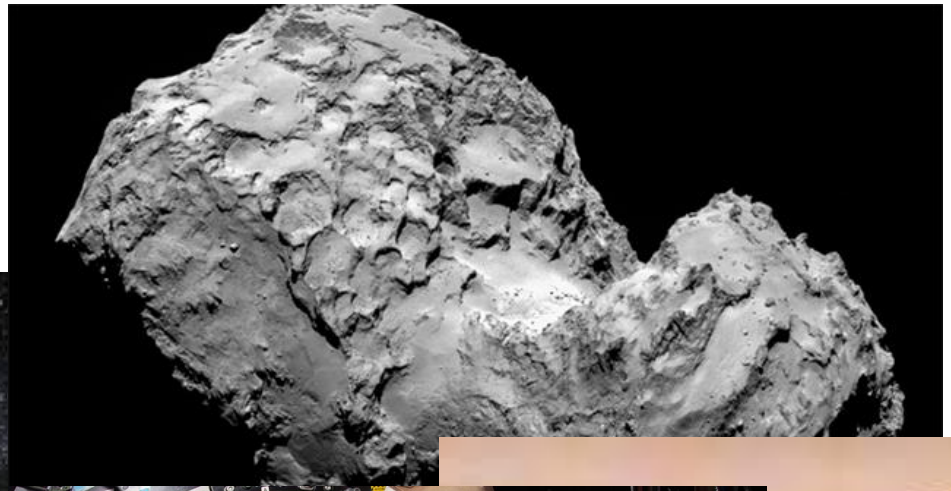


Episode 4: “A New Hope"

“Boots on the Moon by 2024”

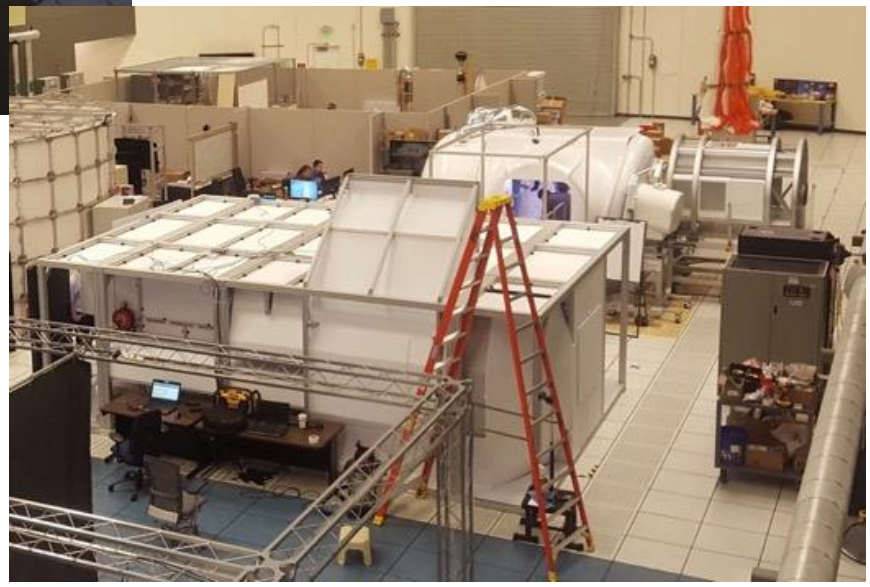
Integrating Humans into a Complex System





Interaction of Crewed Systems

Don’t Get Access to the Operational Environment



NextSTEP: Public/Private Partnership

NextSTEP Phase 1: 2015-2016

Cislunar habitation concepts that leverage commercialization plans for LEO

FOUR SIGNIFICANTLY DIFFERENT CONCEPTS RECEIVED

Partners develop required deliverables, including concept descriptions with concept of operations, NextSTEP Phase 2 proposals, and statements of work.

NextSTEP Phase 2: 2016-2018

FIVE GROUND PROTOTYPES BY 2018

- Partners refine concepts and develop ground prototypes.
- NASA leads standards and common interfaces development.

ONE CONCEPT STUDY

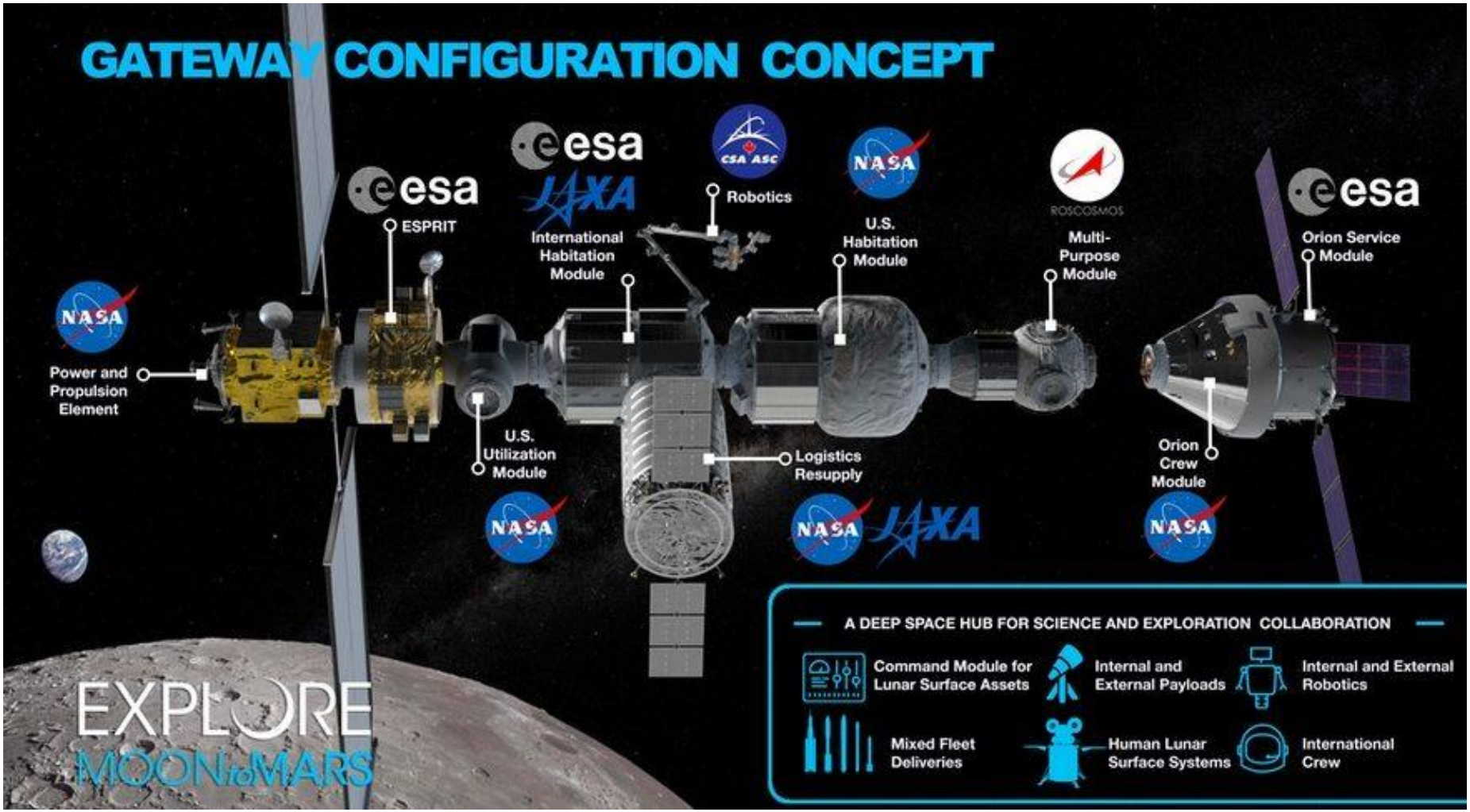
Initial discussions with international partners

NASA Define reference habitat architecture in preparation for Phase 3.

Phase 3: 2018+

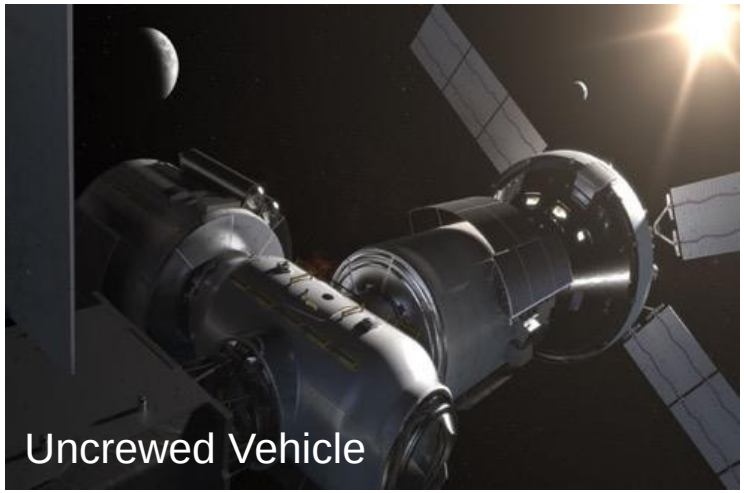
- Partnership and Acquisition approach, leveraging domestic and international capabilities
- Development of deep space habitation capabilities
- Deliverables: flight unit(s)

Gateway: Sustainable Presence/Exploration Testbed

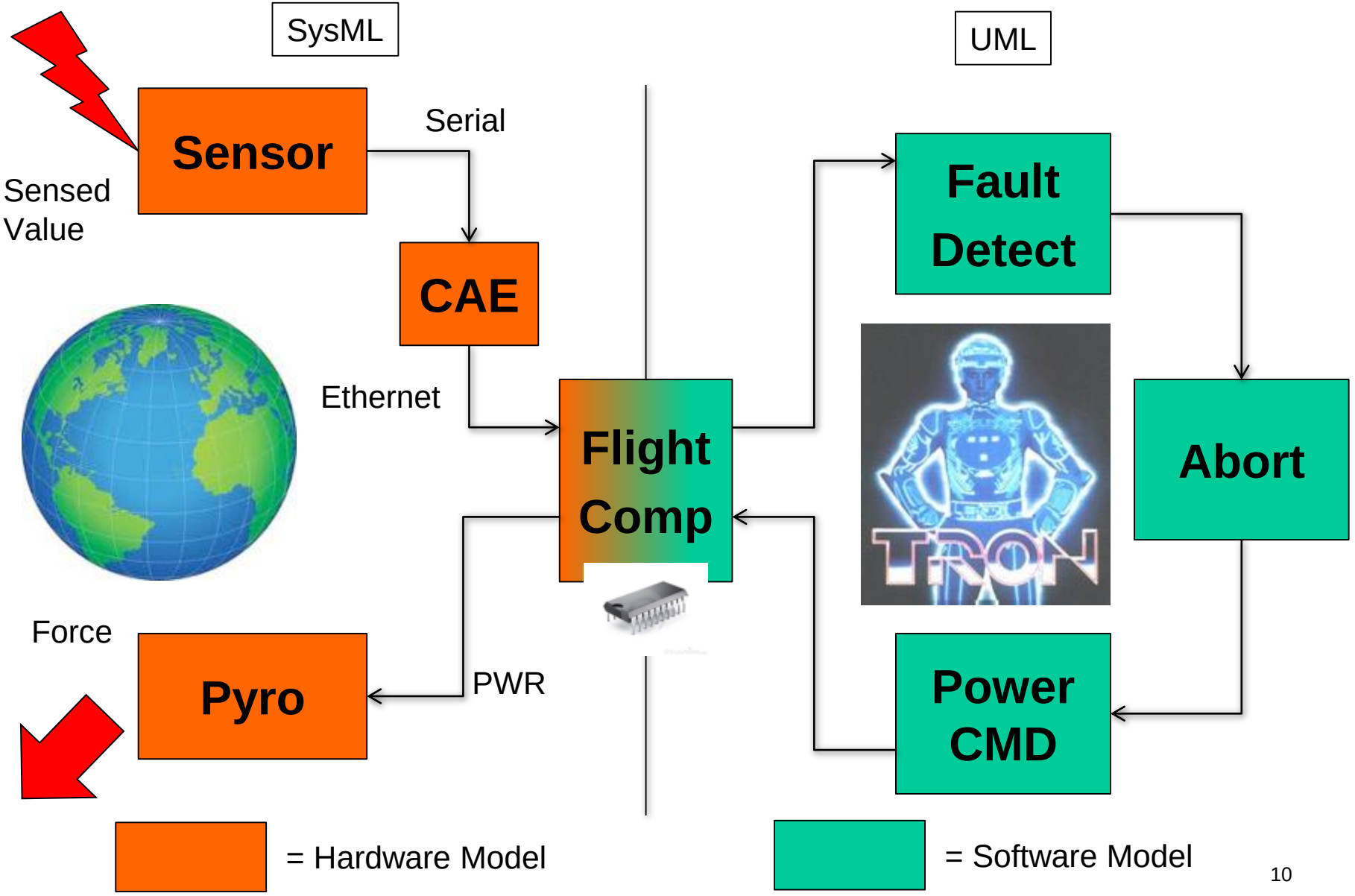


Incremental Assembly : Opportunity for Advancement over Time

Levels of Autonomy (Drives need for FM)



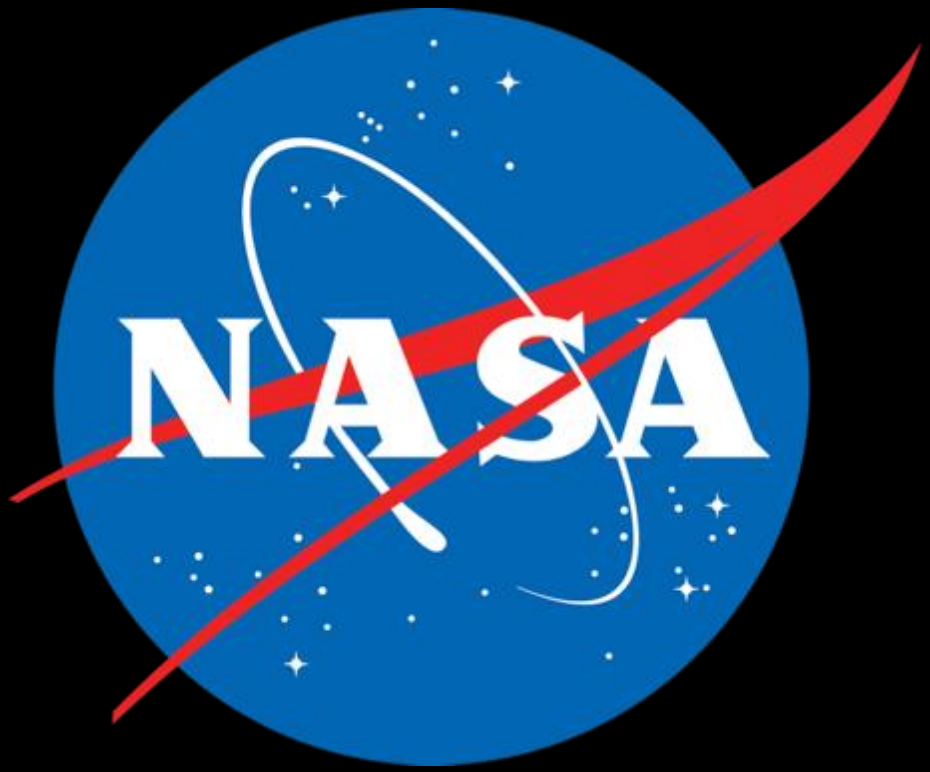
Making Design "Accessible" for Formal Methods



Quick Points

- Safety Critical Application
  - Need reliable metrics for Verification
- No Access to Operational Environment
  - Rely on Digital Representations and Ground Test
- Expedited Schedule
- Increase in Autonomy
- *Mine* Design Artifacts for FM applications
- Strategy: Synthesis of Approaches
  - Apply FM to Digital Representations (Static analysis, Monte Carlo)
  - Verify through Test
  - Mature during Operations
  - Look for future on-ramps, to advance techniques

Formal Methods is Part of the Solution to ensure Successful, Safe Human Spaceflight


NASA